present flora, enumerated at 386 species by Lange, contains a slightly larger number of European than American species. Warming finds two botanical regions, of which the southern is characterized by the presence of the white birch, extending two degrees north from Cape Farewell, and contains many European types. The larger, or northern, region is more American in its facies, but the majority of the plants are circumpolar. Most authors have regarded this flora as of Scandinavian origin; but the suggestion is here made of the possibility of its being merely the wreck of the earlier Tertiary development. The Greenland flora is essentially that of the highest White Mountain summits.

All these and other details concerning the physical features of Greenland help us to imagine the condition of things over our northern regions in the ice age. Greenland must have had a greater development of ice in former times, since the present habitable strip of land is glaciated; but the authors believe it was milder there in the times of the early Norse settlements several hundred years ago. The débris in Greenland is principally transported in the lower part of the glaciers, whence it is possible to believe in a similar movement for the material of the drumlins and many boulders. The Greenland ice moves more rapidly than the Alaskan and Alpine glaciers, averaging about fifty feet daily. This may be due partly to the steeper slopes, which are from 100 to 200 feet per mile. Inclinations of fifty feet to the mile are necessary for vigorous movement; but a large part of the American ice did not possess surface slopes of more than twenty-five or thirty feet to the mile.

Attention is paid to the great elevatory movements of our continent upon both the Atlantic and Pacific coast, as well as on the Gulf of Mexice, which took place in pre-glacial times—from 2,000 to 3,000 feet in amount—and it is thought this uplift has been sufficient to develop the severe glacial climate. The astronomical theories, including the latest views of Croll, Wallace, Drayson, Becker, Sir Robert Ball and Sir John Evans, are weighed in the balance and found wanting in the comparison. The great uplift would have given rise to a high plateau climate with abundant snowfall and accumulation of an ice sheet, whose weight seems to have been a chief cause of the ensuing depression in the Champlain age.

The distribution of the till, more or less coincident with terminal moraines, allows of a classification into stages.

First came the culmination of the Lafayette uplift, which is regarded as Quaternary and therefore not to be esteemed as the equivalent of the Scanian or Norfolkian of Geikie, as they belong to the Pliocene. It includes the Albertan and Saskatchewan stages of G. M. Dawson. Next came the Kansan, Aftonian and Iowan stages, all of the four named being classified as the *Glacial* epoch proper. The second epoch is named the *Champlain*, being the time of melting and of subsidence, and is divided into the Champlain marine beds, the Wisconsin drift sheet indicating moderate reëlevation, the Warren glacial lake, the Toronto stage of temperate climate, the Iroquois lake and the St. Lawrence lake, overflowing through the Champlain basin into the Hudson river. The number of stages agrees exactly with those specified by Geikie for Europe, provided the Lafayette consist of two. The authors rank themselves as advocates of the unity of the glacial epoch. It is probable that the present diverse schools of glacialists will tend hereafter to a greater convergence than divergence. C. H. Hitchcock.

Hansen's Studies in Fermentation. Practical Studies in Fermentation, being contributions to the Life History of Micro-organisms. By Emil Christian Hansen, Ph. D., Professor and Director of the Carlsberg Physiological Laboratory, Copenhagen. Translated by Alex. K. Miller, Ph. D., F. I. C., F. C. S., and Revised by the Author. E. & F. N. Spon, London and New York (12 Courtland St.), 1896. Pp. xiv+277. 8vo. Illustrations. Cloth.

The general features of Dr. Hansen's reform in the fermentative industries have long been known to every one who is interested in the scientific and practical features of applied mycology. They are known as new and important departures in regard to method and application, and as important factors in the evolution of

great industries. Having been successfully outlined in Jörgensen's admirable text-book, 'Micro-organisms and Fermentation' (London, 1893), they are now presented to the public as exhaustively as necessary to the practitioner as well as to those who, without being zymotechnics *ex-professo*, need to become acquainted with the original work of Hansen.

The present volume 'treats,' as the author expresses himself, 'in the main, of the great questions of the circulation in nature of the alcoholic fungi, their relationship to the diseases of beer, the pure cultivation of yeast, and the employment of systematically selected species and races.'

Until the beginning of the last decennium the fermentation of beer, wine, etc., the souring of milk, and other procedures involving an employment of the vitality of micro-organisms, were carried out more or less at random. Pasteur taught us that if the fermentation in beerwort shall terminate in the formation of a fair product, no bacteria must be present in the yeast. Thus, Pasteur's 'pure yeast' refers to yeast free from bacteria. Hansen went further than this. Having discovered the scientific reasons why yeast is not constant with reference to its morphological and physiological peculiarities, he established the maxime, now generally accepted, that yeasts, as commonly used in breweries, are mixtures of cultivated and uncultivated species of *Saccharomyces*, and that most of the latter so-called 'wild' forms are 'disease'-producing, that is, give rise to fermentations unfavorable to both producers and consumers. They were found to cause—aside from certain bacteria which are known to impair the results of fermentations in the brewery —many of the symptoms which are familiar to brewers, such as bitter taste and disagreeable odor, lack of constancy in the product, and the like.

Hansen's studies resulted directly in a method by which it is in the power of any brewery to secure a uniform, good product. Systematically selected culture yeasts would, when introduced into the brewing establishments, be certain to yield uniform, good grades of beer.

The proper selection of races was facilitated by a new method of pure cultivation, allowing the observer to trace the development of cultures from individual well-defined cells.*

The successful introduction of *Hansen's* system into nearly all countries speaks eloquently for its merits.

The major part of the volume refers to the practical side of the question, but, as it is based upon new methods in the study of microscopic fungi, considerable space is devoted also to the botanical study of these, especially of the yeasts. Hence the appropriate sub-title noted above.

The indirect result of Hansen's work is a new departure in the dairy industry. Storch, of Copenhagen, applied the principle of selected species of organisms to the ripening of cream, and was followed by a number of able investigators, among whom is Professor Conn, of this country, who demonstrated the necessity of selecting such forms of the lactic acid bacteria as were found to produce an ideal ripening for rational dairying. In this manner improved grades of butter may be produced and maintained.

The publications of Wortmann and others show that the question of pure cultivation of wine yeasts is rapidly gaining in favor and influence with the German and French manufacturers of wines.

In distilleries the system has also been successfully adopted.

Hansen's late studies of the acetic *bacteria*† seem to indicate a rapidly advancing reform in the manufacture of vinegar, based upon the same principle as has been followed year after year by agriculturists throughout the world, namely, that pure seed secure a pure crop.

Space does not permit a recapitulation of the substantial volume before us. Yet it is evident that every one whose work in any respect touches upon fermentations will find it among those publications which must inevitably be consulted in all future work.

*This method was described exhaustively by the reviewer in the *American Monthly Microscopical Journal*, XV., 35—40, 1894; with plate.

† Comp. rend. d. trav. du laboratoire de Carlsberg III., 265–327, 1894. Ber. d. Deutschen Bot. Ges. XI., (69)–(73), 1893. See also Lafar; Centralbl. f. Bakt. u. Par XIII., 684–697, 1894; idem, zweite Abtheilung, I., 129–150; 1895.

The appearance of the book is in every way faultless. J. Christian Bay.

Iowa State Board of Health,

SCIENTIFIC JOURNALS.

THE AMERICAN GEOLOGIST, APRIL.

Apparent Anomalies of Stratification in the Postville Well: By Samuel Calvin. A recently bored well in northeastern Iowa shows a remarkable and unusual thickness of shaly material in the St. Peter Sandstone. Caverns are frequent in this unconsolidated and easily eroded sandstone, and the author suggests that in this case a cavern was formed in the St. Peter sandstone and it was afterward filled by descending waters with material from the shaly members of the overlying Trenton.

Englacial Drift: By W. O. Crosby. In the longest paper of this number, Prof. Crosby presents a very thorough discussion of the drift which was transported in the lower part of the thick Pleistocene ice sheets, comparing them with the Malaspina Glacier and with the present ice sheet of the interior of Greenland. To designate the drift so enclosed in glaciers and ice sheets, Chamberlin proposed the term englacial, but he supposes that this part was of small amount in comparison with the drift dragged and pushed along beneath the ice as its ground moraine. Crosby shows by the almost universally glaciated surface of the bedrocks beneath the drift, excepting near the borders of the drift-bearing areas, that the ice sheet gathered into its lower part all the preglacial residuary soil and alluvium, until the base of the ice, thickly charged with englacial drift, wore into the hard underlying rocks. With the return of a warm climate, during the Champlain epoch, causing the final recession and departure of the ice, Prof. Crosby thinks that the rapid surface melting was accompanied also by much melting of the base of the ice sheet, whereby much of the previously englacial drift was deposited as subglacial till. It becomes, therefore, difficult to discriminate the finally subglacial deposits from the portion of the drift which continued to be englacial until the surface melting or ablation at last exposed it as superglacial till. The origin of the modified drift, or stratified gravel, sand and clay, brought by streams of water from the drift-laden ice, Prof. Crosby ascribes in its larger part to subglacial drainage, rather than to the superglacial streams which Upham has regarded as the chief agency of derivation of these beds during the mainly rapid final retreat of the ice.

Further examination of the Fisher Meteorite: By N. H. Winchell. Further careful study of this interesting meteorite shows that it contains considerable glass, the mineral asmanite (tridymite), and very probably the mineral maskelynite.

Preliminary Notes on Studies of the Great Lakes made in 1895: By F. B. Taylor. The author states that his explorations and studies during 1895 lead him to doubt his former reference of the high shore lines about the upper great lakes of the St. Lawrence to marine submergence attending or following the close of the Ice Age, instead of which he now concludes that probably all these shores belonged to vast lakes held by the barrier of the waning ice sheet. He asserts, however, that the glacial Lake Warren, according to his exploration of its shores, was limited to the basin of Lake Erie and the southern part of the Huron basin, outflowing by the Pewano channel, southwest of Saginaw Bay, to the glacial Lake Michigan. The very high shores around Lake Superior and the northern part of Lake Huron and Georgian Bay, he attributes to the later Lake Algonquin, with outlet by a river flowing to the south and east along the present bed of Lake Erie.

In an editorial comment by Mr. Warren Upham, referring to Mr. Taylor's paper, it is suggested that only the highest beach which had been attributed to Lake Warren in the Erie basin may represent the Pewamo outlet, and that later stages of Lake Warren, flowing past Chicago to the Des Plaines and Illinois rivers, probably formed the Arkona and Forest or upper or lower Crittenden beaches, and the high shores of the Georgian Bay region, and also of Lake Superior, excepting those of its western part belonging to an earlier glacial lake.

THE MONIST, APRIL, 1896.

Prof. Mach describes a method of using Röntgen's X-rays for obtaining stereoscopic